UPPER BARATARIA BASIN, LOUISIANA

DRAFT FEASIBILITY REPORT

AND

INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

ENGINEERING APPENDIX A

COST ENGINEERING ANNEX 15

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1 UPPER BARATARIA BASIN COST – 1% AEP RECOMMENDED PLAN

1.1 General Cost Information for 1% AEP Recommended Plan

1.1.1 Cost Estimate Development

The 1% AEP recommended plan follows basically the same alignment as State of Louisiana Master plan (100 yr level of protection) US Hwy. 90 Alignment - which starts in Luling, Louisiana where it connects at the Mississippi River levee, extends through the Davis Pond Diversion Structure West Guide Levee and the St. Charles Parish Levee, crosses Bayou Des Allemands and continues parallel along US Hwy. 90 before tying into high ground across the Barataria Basin near Raceland. The Lafourche Basin Levee District Upper Barataria Risk Reduction Conceptual Design Report (LBLDDR), dated December 2018, has already developed the State's master plan alignment to 10% conceptual designs. The main difference between the recommended plan and the State's master plan is the outcome from the Corps' 2020 Hydraulic analysis for a 1% AEP level of flood protection which will require higher levels of protection for 1% AEP recommended plan. With concurrence from PDT, all the structures contained within the LBLDDR alignment would also be utilized in the 1% AEP recommended plan. In addition, three more large hydraulic structures were added in Reach G near Dufrene ponds, a Phillips 66 Pipeline crossing T-wall was added just north of Crawford Pump Station in Reach F and 12 sluice gates connected to new concrete T-walls at Bayou Des Allemands barge gate structure were added in Reach F. Utilizing LBLDDR's quantities for each structure, the structural designer reviewed each of the designs and developed new piling and concrete quantities for structural features of work based on the new design elevations. (LBLDDR used a design elevation - EL.14.5' for most their structures). For levees, the Geotechnical designer utilized LBLDDR boring data and other historical boring information to develop levee sections and lift schedules for each levee reach. From this information Civil designer developed quantities for clearing and grubbing, silt fence, embankment and turf establishment for the 1st lift for each reach and all subsequent levee lifts. Once quantities were provided incorporating the new design elevations the cost estimate could be developed.

Cost estimate for the 1% AEP recommended plan was developed in the latest TRACES MII cost estimating software, using the standard approaches for a feasibility estimate structure regarding labor, equipment, materials, crews, unit prices, quotes, subcontractor and prime contractor markups to develop a Class 3 cost estimate. The philosophy was taken wherever practical within the time constraints. It was supplemented with estimating information from other sources where necessary such as quotes, bid data, and A-E estimates. The estimate assumed a typical application of tiering subcontractors.

The intent of the cost estimate was to provide or convey a "fair and reasonable" estimate and where cost detail was provided, it depicted the local market conditions. All of the construction work (e.g., levees, floodwalls, gate structures, control structures, dredging, excavation, dewatering, pilings, rock, etc.) is common to the gulf coast region. The construction sites are mostly accessible from land with additional water access available for the construction of the barge gate structure. Site access is easily provided from US Hwy.90 and other various local highways. Water access is available from the Gulf Intracoastal Waterway (GIWW) through Lake Salvador, Bayou des Allemands and Petit Lac des Allemands waterways to the barge gate site.

At this time there are no non-structural costs (i.e. house raising or flood proofing buildings) included in the 1% AEP recommended plan, but will be revisited during design phase.

1.1.2 Estimate Structure

The estimate was subdivided by USACE feature Work Breakdown Structure (WBS) codes. Each WBS cost is subdivided into base cost, contingency and total cost.

1.1.3 Bid Competition

It is assumed there will not be an economically-saturated market, and that bidding competition will be present.

1.1.4 Contract Acquisition Strategy

There is no declared contract acquisition plan/type at this time. It is assumed that the contract acquisition strategy will be similar to past projects with some negotiated contracts, focus and preference of small business/8(a) with some large or more complex, unrestricted design/bid/build contracts.

1.1.5 Labor Shortages

It is assumed there will be a normal labor market pulled from the regional gulf coast region.

1.1.6 Labor Rates

Labor rates were developed comparing regional gulf coast labor market wages with the local Davis-Bacon Wage Determination, using whichever was determined greater. Regional gulf coast wage information was formulated from data gathered from approximately 20 different CEMVN construction projects in the Greater New Orleans region and is assumed to be a fair representation of wage rates for the Upper Barataria area.

1.1.7 Materials

Cost quotes were used for the major construction items such as concrete, steel H piling and sheet piling, sod, rock, gravel, sand material, etc., when available. It is assumed that materials, except for borrow material, will be purchased as part of the construction contract and prices include delivery of materials.

All borrow material is assumed to be government furnished. Specific sources for borrow material have not yet been established. This study has identified considerable farmland and commercial borrow sites (e.g., Raceland Raw Sugars and River Birch) within a 15-20 mile radius of the project. Therefore, the PDT assumed average one-way haul distance of 20 miles until a committed borrow source has been confirmed to be available. Haul speeds are estimated using a 30 mph average speed, given the rural access roads and highways that exist in the area.

Until a borrow source has been confirmed the borrow quantity calculations will followed the CEMVN Geotechnical guidance as follows: for hauled levee material, 10 bank cubic yards (BCY) of borrow material = 12 loose cubic yards (LCY) hauled = 8 embankment cubic yards (ECY) compacted.

1.1.8 Quantities

Quantities for levee construction were developed by the Civil designer and are provided in Annex 1 of the Engineering Appendix A. The design parameters and quantities for each representative structures were provided by the structural designer.

The assumed borrow acreage required for 1% AEP recommend plan is 500 acres and was provided by the civil designer.

1.1.9 Equipment

Rates used were based on the 2016 version of USACE EP-1110-1-8, Region III. Adjustments are made for fuel and facility capital cost of money (FCCM). Full FCCM/Cost of Money rate is latest available; Mii program takes EP recommended discount, no other adjustments have been made to the FCCM. Equipment was selected based on historical knowledge of similar projects.

1.1.10 Rental Rates

Judicious use of owned verses rental rates was considered based on typical contractor usage and local equipment availability. Where rental of equipment is typical, rental rates were applied (ie. for marsh excavators in “Heavy Clearing and Grubbing” cost item, Tugboat, marine barges, etc. for barge gate structures and fronting protection where needed).

1.1.11 Fuels

Fuels (e.g., gasoline, on and off-road diesel fuel) for rental equipment were based on local market averages for the gulf coast area. It was discovered that fuels fluctuate irrationally, which is why an average was used.

1.1.12 Crews

Major crew and productivity rates were developed and studied by senior USACE estimators familiar with the type of work. All of the work is typical to the gulf coast area and New Orleans District cost engineers. The crews and productivities were checked by local MVN estimators, discussions with contractors and comparisons with historical cost data. Major crews include haul, earthwork, piling, concrete, and hydraulic dredging.

Most crew work hours were assumed to be 10 hrs. per day at 6 days per week, which is typical to the area. Marine based bucket excavation/dredging operations are assumed to work 2-12 hours shifts 7 days / week.

A 10% markup on labor for weather delay was selectively applied to the labor in major earthwork-placing detail items, and associated items that would be affected by the weather, creating unsafe or

difficult conditions to operate (e.g., trying to run dump trucks on a wet levee) or would be detrimental/non-compliant to the work being performed (such as trying to place/compact material in the rain). The 10% markup was to cover the common practice of paying for labor "showing up" to the job site and then being sent home due to minor weather conditions, which is part of known average weather impacts as reflected within the standard contract specifications. The markup was not applied to small quantities where this can be scheduled around.

1.1.13 Unit Prices

The unit prices found within the various project estimates fluctuate within a range between similar construction units such as floodwall concrete, earthwork and piling. Variances are a result of differing haul distances (by truck or barge), small or large business markups, subcontracted items, designs and estimates by others.

1.1.14 Relocation Costs

Relocation costs are defined as the relocation of public roads, bridges, railroads and utilities required for project purposes. In cases where potential significant impacts were known, relocation costs were included within the cost estimate. Information from Relocations designer indicated relocations of certain public roads (Hwy. 90 and Hwy 18-River Road) were required for the 1% AEP recommended plan. The Relocations designer also provided all utilities to be relocated (i.e. pipe - ownership, diameter, material, product, location) and are shown in Engineering Appendix A. In addition, the Relocation designer provided the proposed method of flood protection for each underground utility (ie. Utility sleeved through a T-wall construction or relocated over the new earthen levee). Relocation of a utility to be sleeved through a T-wall includes excavation, installation of TRS, temporary support pipe, jack-in sheet pile, installation of pipe sleeve, backfill and removal of TRS. Relocation of a utility to be relocated over the earthen levee includes excavation of a trench, including TRS if needed, hot tapping, demo/disposal of existing pipeline, routing new utility, backfill and removal of TRS. For borrow sites, pipeline protection was included where pipelines crossed borrow area may cross haul access roads. Additionally, an Owner PED of 5% and S&A of 8% was added to the cost of each relocation.

1.1.15 Mobilization

For the levee construction items Contractor mobilization (mob.) and demobilization (demob.) are based on the assumption that most of the contractors will be coming from within the gulf coast/southern region. Mob./demob. costs are based on historical studies of detailed government estimates for mob./demob., which are in the range of 5% of the construction costs for most projects with a few having a higher percentage or allowance for very small construction projects.

1.1.16 Field Office Overhead

The estimate used a field office overhead rate of 12% for the prime contractors at budget level development. Based on historical studies and experience, Walla Walla District has recommended typical rates ranging from 9% to 11% for large civil works projects; however, the 9-11% rate does not consider possible incentives such as camps, allowances, travel trailers, meals, etc. which have

been used previously to facilitate large or remote projects. With undefined acquisition strategies and assumed individual project limits, the estimate utilizes a more comprehensive percentage based approach applied at each contract rather than risking minimizing overhead costs by detailing costs based on an assumed number of contracts. The applied rates were previously discussed among numerous USACE District cost engineers including Walla Walla, Vicksburg, Norfolk, Huntington, St. Paul and New Orleans.

1.1.17 Overhead Assumptions

Overhead assumptions may include costs for the superintendent, the office manager, pickup trucks, periodic travel costs, communications, temporary offices (contractor and Government), office furniture, office supplies, computers and software, as-built drawings and minor designs, tool trailers, staging setup, camp/facility/kitchen maintenance and utilities, utility service, toilets, safety equipment, security and fencing, small hand and power tools, project signs, traffic control, surveys, temporary fuel tank station, generators, compressors, lighting and minor miscellaneous.

1.1.18 Home Office Overhead

The estimated percentages range based upon consideration of 8(a), small business and unrestricted prime contractors. The rates were based upon estimating and negotiating experience, and consultation with local construction representatives. Different percentages are used when considering the contract acquisition strategy regarding small business 8(a), competitive small business and large business, high to low, respectively. For prime contractor the Home Office Overhead a percentage of 10% was assumed.

1.1.19 Taxes

Local taxes on supplies and materials needed for construction would be applied based on the parishes that contain the work. Reference the tax rate website for Louisiana: http://www.salestaxstates.com.

1.1.20 Bond

The Bond interest rate was assumed to be 1%, applied against the prime contractor, assuming large contracts. There was no differentiation between large and small businesses.

1.1.21 Real Estate Costs

Real Estate (RE) costs were developed and provided by the Realty Specialist and placed in WBS-02 Lands and Damages. The RE cost for each alternative includes land costs, acquisition costs (including acquisition of agricultural land for borrow) and 25% for contingencies.

1.1.22 Environmental Costs

Environmental costs were provided by the Environmentalist and placed in Work Breakdown Structure WBS-06 Fish and Wild Life Facilities. The Environmental costs includes only mitigation of the flood protection alignment footprint.

1.1.23 Cultural Resources Costs

Cultural Resources (CR) costs were provide by the Archaeologist, Natural/Cultural Resources Analyst and placed in WBS-13 Cultural Resources Preservation. The CR costs include Phase I & II Cultural Surveys and mitigation of resources if required. For borrow sites, known or identified cultural resource sites will be avoided.

1.1.24 Planning, Engineering and Design (PED)

The PED cost included such costs as USACE project management, engineering, planning, designs, investigations, studies, reviews, value engineering (VE) and engineering during construction. Historically, a rate of approximately 12% for Engineering and Design (E&D) portion, plus small percentages for other support features, is applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis and St. Louis have reported values ranging from 10% to 15% for E&D. Additional support features might include project management, engineering, planning, designs, investigations, studies, reviews and VE. A PED rate of 20.5% was applied for this project.

1.1.25 Supervision and Administration (S&A)

Historically, a range from 5% to 15%, depending on project size and type, has been applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis and St. Louis report values ranging from 7.5% to 10%. Consideration includes that a portion of the Supervision and Administration (S&A) effort could be performed by contractors. An S&A rate of 11% was applied for this project.

1.1.26 Contingencies

For the Recommended Plan, a full Cost and Schedule Risk Analysis (CSRA) was developed on the complete project using the Crystal Ball Program. See Project Cost and Schedule Risk Analysis Report for details.

1.1.27 Escalation

The escalation for the structural items taken from the LBLDDR were based upon the latest version of the USACE Engineering Manual (EM) 1110-2-1304, “Civil Works Construction Cost Index System (CWCCIS)”.

1.1.28 Hazardous, Toxic and Radioactive Waste (HTRW)

Phase 1 surveys have not been fully performed, but preliminary investigation by the Biologist indicates no issues were found along the proposed TSP alignment and the risk of finding HTRW in the remaining mostly rural and residential areas of Reaches A, B and C that are along the alignment is low. At this time there is no reason to believe HTRW will be found, therefore, the estimates do not include costs for any potential HTRW.

1.1.29 Schedule

Plan Formulation/Project Management for the UBB study have directed that major construction of the system be assumed to begin in first quarter of FY2024 with a complete 1% AEP risk reduction system in place by end of FY2026. The expected construction duration period is three years with the first lift including all structures completed by 2026 followed by maintenance lift events occurring in 2038, 2041, 2044, 2054, 2056 and 2059.

1.1.30 Cost Estimate

Table 1-1 shows the baseline project cost for the 1% AEP Recommend Plan. This information was taken from the Total Project Cost Sheet (TPCS). See Table 1-2 shows the TPCS for the 1% AEP Recommended Plan. All costs are at November 2020 price levels.

Table 1-1: 1% AEP Recommended Plan

Feature	Cost	Contingency	Total
01 Lands and Damages	$76,863,000	$19,216,000	$96,079,000
02 Relocations	$23,827,000	$6,910,000	$30,737,000
06 Fish and Wildlife Facilities	$339,392,000	$98,424,000	$437,816,000
11 Levees and Floodwalls	$509,516,000	$147,760,000	$657,276,000
15 Floodway Control and Diversion Structures	$181,014,000	$52,494,000	$233,508,000
18 Cultural Resources Preservation	$1,100,000	$319,000	$1,419,000
30 Planning, Engineering & Design	$216,244,000	$62,711,000	$278,955,000
31 Construction Management	$116,033,000	$33,650,000	$149,683,000
TOTAL	$1,463,989,000	$421,482,000	**$1,885,472,000**

Table 1-2: TPCS for 1% AEP Recommended Plan

**** TOTAL PROJECT COST SUMMARY ****

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PROJECT: Upper Barataria Basin (UBB) Feasibility Study
PROJECT NO 1% AEP Recommend Plan - HWY 90 Alignment - Segment 1 Extension
LOCATION: St. Charles Parish & Lafourche Parish, LA

DISTRICT: New Orleans District
POC: CHIEF, COST ENGINEERING, John Petitbon

PREPARED: 11/6/2020

This Estimate reflects the scope and schedule in report: Upper Barataria Basin (UBB) Feasibility Study Report

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2022 Effective Price Level Date: 1 OCT 21									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Spent Thru: 1-Oct-20 ($K)	TOTAL FIRST COST ($K)	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J		K	L	M	N	O
02	RELOCATIONS	$23,827	$6,910	29.0%	$30,737	3.0%	$24,534	$7,115	$31,649	$0	$31,649	7.4%	$26,359	$7,644	$34,003
06	FISH & WILDLIFE FACILITIES	$339,392	$98,424	29.0%	$437,816	3.0%	$349,468	$101,346	$450,814	$0	$450,814	7.4%	$375,456	$108,882	$484,338
11	LEVEES & FLOODWALLS	$509,516	$147,760	29.0%	$657,276	3.0%	$524,643	$152,146	$676,789	$0	$676,789	39.9%	$734,224	$212,925	$947,149
15	FLOODWAY CONTROL & DIVERSION STRUCTUR	$161,014	$52,494	29.0%	$233,508	3.0%	$186,388	$54,053	$240,441	$0	$240,441	7.4%	$200,248	$58,072	$258,320
18	CULTURAL RESOURCE PRESERVATION	$1,100	$319	29.0%	$1,419	3.0%	$1,133	$328	$1,461	$0	$1,461	7.4%	$1,217	$353	$1,570
	#N/A	$0	$0 -		$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0 -		$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0 -		$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$1,054,849	$305,906		$1,360,755	3.0%	$1,086,166	$314,988	$1,401,154	$0	$1,401,154	23.1%	$1,337,504	$387,876	$1,725,380
01	LANDS AND DAMAGES	$76,863	$19,216	25.0%	$96,079	3.0%	$79,145	$19,786	$98,931	$0	$98,931	2.9%	$81,440	$20,360	$101,800
30	PLANNING, ENGINEERING & DESIGN	$216,244	$62,711	29.0%	$278,955	4.0%	$224,879	$65,215	$290,094	$0	$290,094	33.7%	$300,582	$87,169	$387,751
31	CONSTRUCTION MANAGEMENT	$116,033	$33,650	29.0%	$149,683	4.0%	$120,667	$34,993	$155,660	$0	$155,660	38.4%	$166,958	$48,418	$215,376
	PROJECT COST TOTALS:	$1,463,989	$421,482	28.8%	$1,885,472		$1,510,857	$434,983	$1,945,840	$0	$1,945,840	24.9%	$1,886,484	$543,823	$2,430,307

ESTIMATED TOTAL PROJECT COST: $2,430,307

CHIEF, COST ENGINEERING, John Petitbon
PROJECT MANAGER, Sarah Bradley
CHIEF, REAL ESTATE, Judith Gutierrez
CHIEF, PLANNING, Troy Constance
CHIEF, ENGINEERING, Jean Vossen
CHIEF, OPERATIONS, Mike Park
CHIEF, CONSTRUCTION, Stuart Waites
CHIEF, CONTRACTING, Debbie Logan
CHIEF, PM-R, Brad Inman
CHIEF, DPM, Mark Wingate

Filename: 6Nov20 UBB-TPCS 9.2020.xlsx
TPCS

1.1.31 Cost Estimate – 1% AEP Recommended Plan - Mii Project Summary

Mii project Summary for the Recommended Plan is attached at the end of the Annex.

1.1.32 Cost Estimate – 1% AEP Recommended Plan - CSRA Executive Summary

EXECUTIVE SUMMARY

The US Army Corps of Engineers (USACE), New Orleans District, presents this cost and schedule risk analysis (CSRA) report regarding the risk findings and recommended contingencies for the UPPER BARATARIA BASIN FEASIBILITY STUDY 1% AEP Recommended Plan. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated June 30, 2016, a formal risk analysis, a *Monte-Carlo* based-study was conducted by the Project Development Team (PDT) on remaining costs. The purpose of this risk analysis study is to present the cost and schedule risks considered, those determined and respective project contingencies at a recommended 80% confidence level of successful execution to project completion.

The scope of the 1% AEP (100yr future design) Recommended Plan consists of constructing a 30.6-mile flood protection alignment near the communities of Boutte, Paradis, Des Allemands and Raceland. The system starts in Luling, Louisiana where it connects to the Mississippi River Levee through the Davis Pond Diversion Structure West Guide Levee, continues south, improving upon and updating deficiencies in the St. Charles Parish Levee, crosses Bayou Des Allemands with a 270-ft barge gate structure and continues parallel to U.S. Highway 90 before it ties into high ground across the basin near Raceland.

Specific to the Upper Barataria Basin Project, the current project base cost estimate, pre-contingency, approximates $1.055B, excluding Real Estate. This CSRA study excludes “spent” costs, excludes contingencies, and is expressed in FY2021 dollars. Real Estate requirements have not been included in the CSRA since the USACE Real Estate office provides a 25% contingency to be used.

Cost estimates fluctuate over time. During this period of study, minor cost fluctuations can and have occurred. For this reason, contingency reporting is based in cost and per cent values. Should cost vary to a slight degree with similar scope and risks, contingency per cent values will be reported, cost values rounded. Based on the results of the analysis, the Cost Engineering Mandatory Center of Expertise for Civil Works (MCX- located in Walla Walla District) recommends a 29% contingency applied to base cost, excluding Real Estate, at an 80% confidence level of successful project completion. This contingency is applied to construction costs, PED and Construction Management. See Table ES-1.

Table ES-1 Construction Contingency Results

Contingency Table			
Confidence Level	**Base Cost**	**Contingency $**	**Contingency (%)**
50%	$1,054,848,835	$253,163,720	24%
70%	$1,054,848,835	$284,809,185	27%
80%	**$1,054,848,835**	**$305,906,162**	**29%**
90%	$1,054,848,835	$327,003,139	31%

2 UPPER BARATARIA COST – SCREENING PHASE – FINAL ARRAY

2.1 General Cost Information for Final Array of Alternatives (Alternates 1, 2, 7 and 10)

2.1.1 Cost Estimate Development

Cost estimates for the final array of structural alternatives (Alternatives 1, 2 & 10) were developed at a Class 4 Level of effort utilizing largely parametric unit prices from sources such as historical Government and Commercial bid data, Architect/Engineer (A/E) cost estimates available from design reports, 2019 Gordian/RS Means Cost Data Books and other available historical cost data. For developing costs for certain levee construction items such as “Clearing and Grubbing” and “Embankment, Compacted Fill” the standard approaches for developing a feasibility cost regarding cost elements such as labor, equipment, materials, crews, unit prices, subcontractor and prime contractor markups was used. The Lafourche Basin Levee District Upper Barataria Risk Reduction Conceptual Design Report (LBLDDR), dated December 2018, was very useful to the feasibility study in developing costs for structural features of work. The LBLDDR had already developed 10% conceptual designs for all structures in an alignment that would span from the Mississippi River to Raceland and mimic very closely the alignment paths of the final array of structural alternatives, but used a higher design elevation for the structures (EL.14.5’). It was decided by the Project Delivery Team (PDT) that any LBLDDR structure type that fell within the same path along the alternatives’ alignments would also be included in that alternative alignment. The A/E cost estimates from the LBLDDR included itemized quantities in sufficient enough detail as to be useful in prorating the quantities for eight (8) representative structures (Davis Pond Pump Station Fronting Protection, Union Pacific Railroad Gate, Tidal Exchange Structure #1, 270 ft. Barge Gate, 45 ft. Roller Gate, 20 ft. Stop Log Gate, Large Hydraulic Structure and Davis Diversion Pipeline #2 T-wall) at the new design elevation for each alternative. Unit costs for the representative structures were reviewed for reasonableness and then applied to the revised quantities to develop new total costs for the representative structures. The cost factor differential for each representative structure was then applied to other similar structures within each alignment. In the final step, cost of each structure was then escalated to 4th quarter 2019 pricing to develop new costs for all structures. There are 8 pump station structures included in the LBLDDR alignment (Davis Pond PS, Willowdale PS, Willowridge PS, Cousins PS, Kellogg PS, Ellington PS, Magnolia Ridge PS and Crawford Canal PS) which are all located within St. Charles Parish. Seven are existing pump stations and Magnolia Ridge Pump Station is presently being constructed. The Hydraulics designer stated no new pump stations will be required for any of the final array of alternatives, but costs for new fronting protection for these pump stations will be included where necessary based upon the design elevation requirement for each alternative.

The intent of the cost estimate was to provide or convey a “fair and reasonable” estimate and where cost detail was provided, it depicted the local market conditions. All of the construction work (e.g., levees, floodwalls, gate structures, control structures, dredging, excavation, dewatering, pilings, rock, etc.) is common to the gulf coast region. The construction sites are mostly accessible from land with additional water access available for the construction of the barge gate structure. Site access is easily provided from US Hwy.90 and other various local highways. Water access is available from the Gulf

Intracoastal Waterway (GIWW) through Lake Salvador, Bayou des Allemands and Petit Lac des Allemands waterways to the barge gate site.

The cost estimate for the non-structural alternative (NS1 or Alternative 7) was developed to capture costs for elevating residential structures and flood proofing non-residential structures in which the first floor elevation was below the FWOP flood stage and where flood damages would be expected to occur. Inventory of the residential and non-residential structures and foundation heights were developed using the National Structure Inventory (NIS) version 2 and foundation heights from the 2010 Donaldsonville to the Gulf Feasibility Study: Residential and Non-Residential Structure Inventory.

Elevation costs for residential structures were based on the difference in the number of feet between the original first floor elevation and the target elevation (100 year future-without project stage) for each structure. The number of feet that each structure was raised was rounded to the closet one-foot increment, with the exception that structures less than one foot below the target elevation were rounded up to one foot. The costs per square foot for raising residential structures were developed using previous unit costs from the 2012 Donaldsonville to the Gulf Feasibility Study evaluation. The previous unit costs were calculated from data collected from interviews with representatives of three major metropolitan New Orleans area firms that specialize in structure elevation; these October 2011 unit costs were then escalated to October 2019 prices. (See Engineering Appendix A, Section 2.7.3, Table 2-1: Cost per square foot to Raise Residential Structures (October 2019 Price Level). Composite costs were derived for residential structures by type: slab and pier foundation, one- story and two-story configuration and for mobile homes. These composite unit costs also vary by the number of feet that structures may be elevated. The cost per square foot to raise an individual structure to the target height was multiplied by the footprint square footage of each structure to compute the costs to elevate the structure. Additionally, a labor estimate of $15,000 per structure to complete required administrative activities by the Federal sponsor in implementing this nonstructural measure was added to the cost of implementation. Additionally, a real estate cost of $15,000 per structure was added to the cost of implementation. Elevation costs by structure were summed to yield an estimate of total structure elevation costs.

Dry flood proofing costs for non-residential structures were developed based on their relative square footage. Separate costs were assigned to three ranges of square footage based on previous costs developed for the 2012 Donaldsonville to the Gulf Feasibility Study evaluation by contacting local contractors and escalated to October 2019 prices. Additionally, a labor estimate of $15,000 per structure to complete required administrative activities by the Federal sponsor in implementing this nonstructural measure was added to the cost of implementation. Additionally, a real estate cost of $15,000 per structure was added to the cost of implementation. Flood proofing costs by structure were summed to yield an estimate of total structure flood proofing costs.

The non-structural costs for elevating and flood proofing were then combined. As the first cost was over $1.1 Billion, the PDT decided as a first run to apply the 34.5% risk contingency that was originally developed for the Southwest Coastal Study NED/TSP non-structural alternative which is similar in scope and risks to the UBB non-structural alternative. As the resultant benefit-to-cost ratio (BCR) fell well below unity(BCR = 0.3) with the contingency and would still fall below unity without the contingency, the alternative no longer was economically justifiable, therefore, no further effort was placed on this alternative.

2.1.2 Estimate Structure

The estimates have been subdivided by alternative and each estimate contains USACE feature Work Breakdown Structure (WBS) codes. Each WBS cost is subdivided into base cost, contingency and total cost.

2.1.3 Bid Competition

It is assumed there will not be an economically-saturated market, and that bidding competition will be present.

2.1.4 Contract Acquisition Strategy

There is no declared contract acquisition plan/type at this time. It is assumed that the contract acquisition strategy will be similar to past projects with some negotiated contracts, focus and preference of small business/8(a) with some large, unrestricted design/bid/build contracts.

2.1.5 Labor Shortages

It is assumed there will be a normal labor market pulled from the regional gulf coast region.

2.1.6 Labor Rates

Labor rates used for “Clearing and Grubbing” and “Embankment, Compacted Fill” items were developed comparing regional gulf coast labor market wages with the local Davis-Bacon Wage Determination, using whichever was determined greater. Regional gulf coast wage information was formulated from data gathered from approximately 20 different CEMVN construction projects in the Greater New Orleans region and is assumed to be a fair representation of wage rates for the Upper Barataria area.

2.1.7 Materials

As parametric unit costs were used for the major construction items such as concrete, steel H piling and sheet piling, HPTRM, sod, rock, gravel, sand material, etc., no material quotes were obtained at this time. Material prices for steel piping used in relocation costs was taken from the 2019 Heavy Construction Costs RS Means Data Book. It is assumed that materials, except for borrow material, will be purchased as part of the construction contract and prices include delivery of materials.

All borrow material is assumed to be government furnished. Specific sources for borrow material have not yet been established. There is considerable farmland and commercial borrow sites (e.g., Raceland Raw Sugars and River Birch) within a 15 mile radius of the project. Therefore, the PDT assumed average one-way haul distance of 15 miles until a committed borrow source has been confirmed to be available. Haul speeds are estimated using a 35 mph average speed, given the rural access roads and highways that exist in the area.

Until a borrow source has been confirmed the borrow quantity calculations will followed the CEMVN Geotechnical guidance as follows: for hauled levee material, 10 bank cubic yards (BCY) of borrow material = 12 loose cubic yards (LCY) hauled = 8 embankment cubic yards (ECY) compacted.

2.1.8 Quantities

The PDT decided that for each alternative a single design elevation would be the used across the entire alignment to calculate levee quantities. This single design elevation was determined by calculating the mean average of all the design elevations for that alignment. Quantities for levee construction were developed by the civil designer for the various alternatives and are provided in Annex 1 of the Engineering Appendix A. The PDT also decided at this time that 2 feet would be added to the design elevation for all structures to address structural superiority. In feasibility level design it will be further investigated, whether this additional 2 feet will be necessary for all structural applications based on the latest HSDRRS design criteria. Eight representative structures (Davis Pond Pump Station Fronting Protection, Union Pacific Railroad Gate, Tidal Exchange Structure #1, 270 ft. Barge Gate, 45 ft. Roller Gate, 20 ft. Stop Log Gate, Large Hydraulic Structure and Davis Diversion Pipeline #2 T-wall) were selected from the LBLDDR including their respective A/E costs. The design parameters and quantities for each representative structure were changed by the structural designer to meet the new design elevations for each alternative and new costs were developed for each representative structure for each alternative. The new cost divided by the old cost created a cost factor for each of these eight representative structures that was then applied to other similar structures in the alignment to generate new costs for those structures. During feasibility level design of the TSP all the structures within the proposed alignment will be further developed and the associated quantities individually defined.

The assumed borrow acreage required for Alt. 1 is 54 acres, Alt. 2 is 74 acres and Alt. 10 is 226 acres.

2.1.9 Equipment

Rates used for “Clearing and Grubbing” and “Embankment, Compacted Fill” cost items were based on the 2016 version of USACE EP-1110-1-8, Region III. Equipment was selected based on historical knowledge of similar projects.

2.1.10 Rental Rates

Where rental of equipment is typical, rental rates were applied (ie. for marsh excavators in “Heavy Clearing and Grubbing” cost item).

2.1.11 Fuels

Fuels (e.g., gasoline and diesel fuel) for rental equipment were based on local market averages for the gulf coast area. It was discovered that fuels fluctuate irrationally, which is why an average was used.

2.1.12 Crews

For “Clearing and Grubbing” and “Embankment, Compacted Fill” cost items crew work hours were assumed to be 10 hrs. per day at 6 days per week, which is typical to the area.

A 10% markup on labor for weather delay was selectively applied to the labor in major earthwork-placing detail items, and associated items that would be affected by the weather, creating unsafe or difficult conditions to operate (e.g., trying to run dump trucks on a wet levee) or would be detrimental/non-compliant to the work being performed (such as trying to place/compact material in the rain). The 10% markup was to cover the common practice of paying for labor “showing up” to the job site and then being sent home due to minor weather conditions, which is part of known average weather impacts as reflected within the standard contract specifications.

2.1.13 Unit Prices

The unit prices found within the various project estimates fluctuate within a range between similar construction units such as floodwall concrete, earthwork and piling. Variances are a result of differing haul distances (by truck or barge), small or large business markups, subcontracted items, designs and estimates by others.

2.1.14 Relocation Costs

Relocation costs are defined as the relocation of public roads, bridges, railroads and utilities required for project purposes. In cases where potential significant impacts were known, relocation costs were included within the cost estimate. Information from Relocations Designer showed no relocations of public roads, bridges or railroads were required for these alternatives. The Relocations designer did provide all utilities to be relocated for each of the alternatives (i.e. pipe - ownership, diameter, material, product, location) and are shown in Engineering Appendix A, Section 2.15.3, Tables 2-2, 2-3 and 2-4. In addition, the Relocation designer provided the proposed method of flood protection for underground pipe (ie. pipeline sleeved through a T-wall construction or relocated over the new earthen levee). Relocation of a pipeline to be sleeved through a T-wall includes excavation, installation of TRS, temporary support pipe, jack-in sheet pile, installation of pipe sleeve, backfill and removal of TRS and cost provided was based on historical bid data. Relocation of a pipeline to be relocated over the earthen levee includes excavation of a trench, including TRS if needed, hot tapping, demo/disposal of existing pipeline, routing new pipeline, backfill and removal of TRS. Cost was developed using historical cost data and 2019 Heavy Construction Gordian/RS Means Data Book. Additionally, an Owner PED of 5% and S&A of 8% was added to the cost of each relocation. Relocation costs were placed in Work Breakdown Structure WBS-02 Relocations.

2.1.15 Mobilization

For the levee construction items Contractor mobilization (mob.) and demobilization (demob.) are based on the assumption that most of the contractors will be coming from within the gulf coast/southern region. Mob./demob. costs are based on historical studies of detailed government estimates for mob./demob., which are in the range of 3% to 5% of the construction costs.

2.1.16 Field Office Overhead

The “Clearing and Grubbing” and “Embankment, Compacted Fill” items used a field office overhead rate of 25% for the prime contractors based on historical projects such as ABL - West Bayou Sale North Bend Phase B and MRL- Carrolton Phase II.

2.1.17 Overhead Assumptions

Overhead assumptions may include costs for the superintendent, the office manager, pickup trucks, periodic travel costs, communications, temporary offices (contractor and Government), office furniture, office supplies, computers and software, as-built drawings and minor designs, tool trailers, staging setup, camp/facility/kitchen maintenance and utilities, utility service, toilets, safety equipment, security and fencing, small hand and power tools, project signs, traffic control, surveys, temporary fuel tank station, generators, compressors, lighting and minor miscellaneous.

2.1.18 Home Office Overhead

The estimated percentages range based upon consideration of 8(a), small business and unrestricted prime contractors. The rates were based upon estimating and negotiating experience, and consultation with local construction representatives. Different percentages are used when considering the contract acquisition strategy regarding small business 8(a), competitive small business and large business, high to low, respectively. For Home Office Overhead a percentage of 13% was assumed.

2.1.19 Taxes

Local taxes on supplies and materials needed for construction would be applied based on the parishes that contain the work. Reference the tax rate website for Louisiana: http://www.salestaxstates.com.

2.1.20 Bond

The Bond interest rate was assumed to be 1%, applied against the prime contractor, assuming large contracts. There was no differentiation between large and small businesses.

2.1.21 Real Estate Costs

Real Estate (RE) costs were developed and provided by the Realty Specialist and placed in WBS-02 Lands and Damages. The RE cost for each alternative includes land costs, acquisition costs (including acquisition of agricultural land for borrow) and 25% for contingencies.

2.1.22 Environmental Costs

Environmental costs were provided by the Environmentalist and placed in Work Breakdown Structure WBS-06 Fish and Wild Life Facilities. The Environmental costs for each alternative includes only mitigation of the flood protection alignment footprint.

2.1.23 Cultural Resources Costs

Cultural Resources (CR) costs were provide by the Archaeologist, Natural/Cultural Resources Analyst and placed in WBS-13 Cultural Resources Preservation. The CR costs for each alternative include

Phase I & II Cultural Surveys and mitigation of resources if required. For borrow sites, known or identified cultural resource sites will be avoided.

2.1.24 Planning, Engineering and Design (PED)

The PED cost included such costs as USACE project management, engineering, planning, designs, investigations, studies, reviews, value engineering (VE) and engineering during construction. Historically, a rate of approximately 12% for Engineering and Design (E&D) portion, plus small percentages for other support features, is applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis and St. Louis have reported values ranging from 10% to 15% for E&D. Additional support features might include project management, engineering, planning, designs, investigations, studies, reviews and VE. A PED rate of 20.5% was applied for this project.

2.1.25 Supervision and Administration (S&A)

Historically, a range from 5% to 15%, depending on project size and type, has been applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis and St. Louis report values ranging from 7.5% to 10%. Consideration includes that a portion of the Supervision and Administration (S&A) effort could be performed by contractors. An S&A rate of 11% was applied for this project.

2.1.26 Contingencies

Contingencies for the final array of structural alternatives were developed using the USACE Abbreviated Cost Risk Analysis (ARA) program. An ARA is a qualitative approach used by the PDT to address key risk concerns for major features of work and their impact to cost and schedule drivers such as Project Scope Growth, Acquisition Strategy, Construction Elements, Quantities, Specialty Fabrication or Equipment, Cost Estimate Assumptions and External Project Risks. A separate ARA was conducted for Alternatives 1 and 2, with each analysis resulting in a composite risk contingency of approximately 31%. As Alternative 10 was added very late as a final alternative, it was decided by PDT that the same 31% composite risk contingency could logically be applied to Alternative 10, since each of the three structural alternatives had the same features of work and very similar risk concerns. It should be noted Real Estate, PED and S&A costs were not included in formulating the composite risk contingency.

2.1.27 Escalation

The escalation for the structural items taken from the LBLDDR were based upon the latest version of the USACE Engineering Manual (EM) 1110-2-1304, “Civil Works Construction Cost Index System (CWCCIS)”.

2.1.28 Hazardous, Toxic and Radioactive Waste (HTRW)

Phase 1 surveys have not been performed, but preliminary investigation by the Biologist indicates no issues were found along the proposed final alternative alignments and the risk of finding HTRW in the

mostly rural and residential areas that are along the alignment is low. At this time there is no reason to believe HTRW will be found, therefore, the estimates do not include costs for any potential HTRW.

2.1.29 Schedule

The project schedule for each structural alternative was developed based on the construction features of work. A generic construction schedule was applied to all of the alternatives for comparison purposes.

Plan Formulation/Project Management for the UBB study have directed that construction of the system be assumed to begin in 2020 with a complete risk reduction system in place by 2023. The expected construction period for Alternatives 1 & 2 are each three years. The expected construction period for Alternative 10 is three years for the first lift including all structures followed by maintenance lift events, each 1-2 years in duration, occurring in 2033, 2038, 2053, 2062 and 2064.

2.1.30 Cost Estimates

The final array of alternatives, from which a TSP was selected, consisted of Alternatives 1, 2, 7, 10 and the future without project conditions. Tables 1-1 through 1-3 show the baseline project cost for each structural alternative in the final array. All costs are at October 2019 price levels.

***Table 1-1: Alternative 1 – U.S. Highway 90 – Segment 1 Extension, 7.5ft**

Feature	Cost	Contingency	Total
01 Lands and Damages	$3,907,000	$977,000	$4,884,000
02 Relocations	$21,434,000	$6,587,000	$28,021,000
06 Fish and Wildlife Facilities	$57,557,000	$17,689,000	$75,246,000
11 Levees and Floodwalls	$140,569,000	$43,201,000	$183,770,000
15 Floodway Control and Diversion Structures	$86,519,000	$26,590,000	$113,109,000
18 Cultural Resources Preservation	$682,000	$210,000	$892,000
30 Planning, Engineering & Design	$50,947,000	$15,658,000	$66,605,000
31 Construction Management	$27,337,000	$8,402,000	$35,739,000
TOTAL	$388,952,000	$119,314,000	**$508,266,000**

***Table 1-2: Alternative 2 – U.S. Highway 90 – Full Alignment, 8.5 ft**

Feature	Cost	Contingency	Total
01 Lands and Damages	$4,743,000	$1,186,000	$5,929,000
02 Relocations	$29,226,000	$9,001,000	$38,277,000
06 Fish and Wildlife Facilities	$75,818,000	$23,350,000	$99,168,000
11 Levees and Floodwalls	$196,480,000	$60,510,000	$256,990,000
15 Floodway Control and Diversion Structures	$95,748,000	$29,488,000	$125,236,000
18 Cultural Resources Preservation	$694,000	$214,000	$908,000
30 Planning, Engineering & Design	$65,898,000	$20,295,000	$86,193,000
31 Construction Management	$35,360,000	$10,890,000	$46,250,000
TOTAL	$503,967,000	$154,934,000	**$658,901,000**

***Table 1-3: Alternative 10 – 1% AEP Open Basin, 12.0 ft**

Feature	Cost	Contingency	Total
01 Lands and Damages	$5,365,000	$1,341,000	$6,706,000
02 Relocations	$19,270,000	$5,916,000	$25,186,000
06 Fish and Wildlife Facilities	$55,920,000	$17,167,000	$73,087,000
11 Levees and Floodwalls	$371,317,000	$113,994,000	$485,311,000
15 Floodway Control and Diversion Structures	$88,383,000	$27,134,000	$115,517,000
18 Cultural Resources Preservation	$853,000	$262,000	$1,115,000
30 Planning, Engineering & Design	$98,189,000	$30,144,000	$128,333,000
31 Construction Management	$52,687,000	$16,175,000	$68,862,000
TOTAL	$691,984,000	$212,133,000	**$904,117,000**

* All costs for Tables 1-1 through 1-3 above do not include costs for armoring.

The total baseline project cost for the nonstructural alternative (NS1 or Alternative 7) is $1,568,912,000.

2.1.31 NED Plan/Tentatively Selected Plan

The final array of alternatives were compared based on a variety of factors such as input from economics, hydraulic impacts and non-Federal sponsor coordination. Alternatives 1 and 2 were found to have positive net benefits, 1.5 and 1.2, respectively. Alternative 7(NS1) was not economically justified as a standalone alternative at a BCR of 0.3. Alternative 10 was eliminated from consideration due to a further economic adjustment, which yielded a BCR of 0.95. Based on the economic analysis of the final array of alternatives the National Economic Development (NED) plan is Alternate 1 – US Highway 90 – Segment 1 Extension, which is also the PDT's Tentatively Selected Plan (TSP).

For the final array of structural alternatives, armoring of the flood protection system for resiliency had not been fully vetted; therefore, costs for armoring was not included in any of the alternatives. As the flood protection system would need some type of armoring to allow for resiliency during elevated overtopping rates, the PDT agreed armoring would be provided along the entire levee alignment, including the existing St. Charles Parish Levee, regardless of which alternative was chosen. With consensus from the civil designer the armoring designs for Alt. 1, 2 & 10 would likely look very similar along the alignment, but Alt. 2 & Alt. 10 would need to protect more cross sectional area due to greater system design elevations; therefore, would be more costly. Based on this information, the addition of armoring costs to the alternatives would not have changed the NED/TSP selection. As part of a sensitivity analysis to indicate a range of probable additional costs for armoring, costs were developed for armoring Alt.1 (NED/TSP) with either (1) High Performance Turf Reinforcement Matting (HPTRM) system or by utilizing (2) concrete armoring as the most extreme case. Applying an armoring unit cost/SY for each method to the estimated SY of armoring over the length of the flood protection alignment calculated an additional cost of $47,000,000 for HPTRM and $140,000,000 for concrete. Adding each respective armoring cost to the baseline or first cost, Alt. 1 using HPTRM is $555,266,000 and for Alt. 1 using concrete is $648,266,000. Utilizing either armoring design, Alternate 1 would still maintained a positive net benefit of between 1.2 and 1.4; therefore, is still the PDT's Tentatively Selected Plan (TSP). The armoring system design for the NED/TSP will be further defined and optimized during feasibility level design.

As part of system optimization during Feasibility Level design, in conjunction with new hydraulic information from "Future With Project Conditions" and associated overtopping conditions, non-structural measures could be re-introduced in certain targeted populated areas.

UBB 1% AEP Recommend Plan - Hwy 90 Alignment - Segment 1 Extension

The scope of the 1% AEP (100yr future design) Recommended Plan consists of constructing a 30.6-mile flood protection alignment near the communities of Boutte, Paradis, Des Allemands and Raceland. The system starts in Luling, Louisiana where it connects to the Mississippi River Levee through the Davis Pond Diversion Structure West Guide Levee, continues south, improving upon and updating deficiencies in the St. Charles Parish Levee, crosses Bayou Des Allemands with a 270-ft barge gate structure and continues parallel to U.S. Highway 90 before it ties into high ground across the basin near Raceland.

Estimated by	
Designed by	
Prepared by	Gina Foley
Preparation Date	11/5/2020
Effective Date of Pricing	11/5/2020
Estimated Construction Time	Days

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
bid schedule summary			**1,052,512,897.89**	**2,335,936.83**	**0.00**	**1,054,848,834.71**
			21,490,827.28			*23,826,764.11*
02 Relocations	**1.0000**	**JOB**	**21,490,827.28**	**2,335,936.83**	**0.00**	**23,826,764.11**
			339,391,884.00			*339,391,884.00*
06 Fish and Wildlife Facilities	**1.0000**	**JOB**	**339,391,884.00**	**0.00**	**0.00**	**339,391,884.00**
			509,516,498.16			*509,516,498.16*
11 Levees and Floodwalls	**1.0000**	**JOB**	**509,516,498.16**	**0.00**	**0.00**	**509,516,498.16**
			181,013,688.45			*181,013,688.45*
15 Floodway Control-Diversion Structure	**1.0000**	**EA**	**181,013,688.45**	**0.00**	**0.00**	**181,013,688.45**
			1,100,000.00			*1,100,000.00*
18 Cultural Resource Preservation	**1.0000**	**EA**	**1,100,000.00**	**0.00**	**0.00**	**1,100,000.00**

Labor ID: NOLL2019 EQ ID: EP18R03 Currency in US dollars TRACES MII Version 4.4